

A16 regulated position in terms of rotation of the developer carrying member and the clearance regulating member has a leading edge provided to be free from contact with the developer.

REMARKS

Claims 1 to 7 are in the application and stand rejected under 35 U.S.C. §102(b) as being anticipated by Takeda, et al. The Examiner's comments made in the Office Action have been considered and claims 1 and 6, from which the other claims in the application depend, have been amended in order to more clearly define what Applicants consider to be inventive, and to distinguish the invention over the prior art.

Moreover, the specification has been amended throughout in order to correct language defects of spelling and grammar to otherwise extend the use of idiomatic English in the description of the invention. In particular, as required by the Examiner, the sentences appearing on page 14, at lines 3 to 5 and lines 13 and 14, respectively, have been deleted and reference made instead, not to any particular claims, but rather to various aspects of the invention.

The Examiner's objection to the Summary of the Invention under M.P.E.P. §608.01(d) is noted; however, it is not seen that this portion of the specification, as presented, violates any proscription of M.P.E.P. §608.01(d). On the contrary, the Manual expressly indicates that this portion of the specification is intended to apprise those interested in the particular art, to which the invention relates, of the nature of the invention and should set out the exact nature, operation and purpose of the invention. Applicants submit that it is with this intent that the concerned

portion of the specification was prepared. While admittedly being somewhat lacking in brevity, the invention summary is so only because it explains for the benefit of interested readers the underlying philosophy utilized to arrive at the invention. This explanation as it is submitted is properly present in the Summary of the Invention portion of the specification rather than elsewhere therein. Accordingly, Applicants respectfully request that this application objection to the specification be reconsidered and withdrawn.

Going now to the claims, it is submitted that the rejection of claims 1 to 7 is not well taken, particularly with regard to the claims as amended, which are directed to an improved developing unit configuration for an image forming apparatus whereby developer contained therein is prevented from scattering by preventing air pressure in the developing unit from increasing without damaging a surface of the photosensitive member. According to the claimed invention, therefore, there is provided in the developing unit, first, a developer-carrying member which rotates against gravity with respect to a contacting point with, or a point closest to, the photosensitive member. Secondly the developing unit includes a clearance regulating member which is disposed to be free from contact with the surface of the developer carrying member and operative for regulating the clearance for an upper side of the developer-carrying member with the clearance regulating member having a leading edge disposed to be free from contact with the developer.

Applicants' submit that the rejection of claims 1-7 under 35 U.S.C. §102(b) as being anticipated by Takeda, et al. is improper as against the claims as amended for the reason that, while the embodiment of the invention shown in Fig. 6 of the reference employs a developer-

carrying member 22 rotated in a direction against gravity, it is clear that the blade 24 which constitutes the clearance-regulating member of the device does not regulate a clearance for an upper side of the developer-carrying member, as required by all of the claims, but instead has the blade 24 disposed to regulate developer clearance at the lower side of the developer-carrying member.

Accordingly, because the Takada, et al. reference discloses no clearance regulating member that regulates a clearance for an upper side of the developer-carrying member while being free from contact with the developer, as claimed, it is submitted that the reference fails to anticipate the claimed invention. The claims therefore are patentable over the reference and should be allowed.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

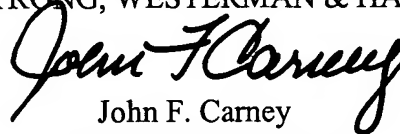
Attached hereto is a marked-up version of the changes made to the by the current amendment. The attached page is captioned "Version with markings to show changes made."

10/050,173

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees, which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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PATENT TRADEMARK OFFICE

Enclosures: Version with markings to show changes made
Request for Approval of Drawing Corrections w/Fig. 6 marked in red ink

VERSION WITH MARKINGS TO SHOW CHANGES MADE 10/050,173**IN THE SPECIFICATION**

The specification was amended as follows:

The paragraph beginning at page 1, line 24, was replaced with the following rewritten paragraph:

When the rotational direction of the developing roller 3 in the developing unit 2 is set such that the developing roller rotates in a direction against gravity at a contacting point of the developing unit 2 with, or a point of the developing unit closest to, the photosensitive member 1a, air is introduced into the developing unit 2 through the clearance above the developing roller 3 by rotation of the developing roller 3 as shown in FIG. 18 to increase the air pressure in the developing unit 2, causing the air in the developing unit 2 to be discharged through a gap of the developing unit 2 or lateral gaps at both ends of the developing roller 3. Concomitantly, some part of the developer stored in the developing unit 2 blows out through these gaps, contaminating the interior of the apparatus or scattering the developer.

The paragraph beginning at page 2, line 13, was replaced with the following rewritten paragraph:

One [of] available protection [measures] measure is that the clearance above the developing roller 3 is eliminated to prevent the inner pressure in the developing unit 2 from increasing.

However, when the cover 203 is configured to have a leading edge put into contact with a surface of the photosensitive member 1a, the surface of the photosensitive member 1a is apt to be damaged by the leading edge, which is not desirable.

The paragraph beginning at page 2, line 21, was replaced with the following rewritten paragraph:

The present invention is proposed in consideration of [the] these problems and provides an image forming apparatus capable of preventing a developer from scattering from a developing unit by preventing the air pressure in the developing unit from increasing without damaging a surface of a photosensitive member. Another object of the present invention is to provide a developing device capable of preventing a developer stored therein from scattering as well.

The paragraph beginning at page 3, line 4, was replaced with the following rewritten paragraph:

In order to attain [an object] the foregoing objects, the present invention adopts an arrangement for regulating a clearance for a surface of a developer [carrying member] above the developer carrying member as stated later on. The present invention clarifies [what] the extent [of] to which the clearance is effective, where a clearance regulated position should be located, to what extent a clearance regulated range is set, and what shape of a clearance regulating portion is preferable.

The paragraph beginning at page 3, line 18, was replaced with the following rewritten paragraph:

a developing unit including a developer carrying member rotatable in a direction against gravity at a contacting point with, or a point closest to, the photosensitive member, and a cover for sealing a developer to be conveyed by the developer carrying member therein, the developer carrying member carrying and conveying the developer stored in the cover to develop the electrostatic latent image on the photosensitive member; and

The paragraph beginning at page 4, line 18, was replaced with the following rewritten paragraph:

The developer carrying member may be configured to be a developing roller, a brush, a belt, and so on. The developer carrying member may be configured in any fashion as long as it rotates, carrying the developer thereon.

The paragraph beginning at page 4, line 23, was replaced with the following rewritten paragraph:

With respect to the rotational direction of the developer carrying member 3a rotatable in the direction against gravity at the contacting point with, or the point closest to, the photosensitive member 1a, there are examples shown in FIGS. 19(a), (b), (c) and (d) with respect of [combination] combinations of the developer carrying member 3a with the photosensitive member 1a. In the case of the developing unit 2 having the developer carrying member 3a rotating in such a rotational

direction, the developer is apt to scatter since air is introduced into the developing unit 2 by rotation of the developer carrying member 3a to increase the inner pressure in the developing unit 2 as stated earlier. In the present invention, the clearance regulating member prevents air from being introduced. The inventors have found [on] by experiments stated later that there are significant differences according to the extent in regulation of the clearance, and the inventors have attained the present invention.

The paragraph beginning at page 6, line 2, was replaced with the following rewritten paragraph:

FIG. 2 shows the results of an experiment. As shown in this figure, the amount of a scattered developer drastically decreases at a clearance size L of 3.5 mm as a threshold. At this threshold, the magnetic brush of the developer, which was located at a magnetic pole just downstream of a position regulated by the clearance regulating member in terms of rotation of the developing roller 3, had a height T of 3.5 mm.

The paragraph beginning at page 6, line 19, was replaced with the following rewritten paragraph:

Another similar experiment, which was carried out with the magnetic force of the developing roller 3 further modified, shows that the amount of a scattered developer drastically decreases at a regulated value as a threshold. This regulated value was a clearance size L of [3,8] 3.8 mm, and the magnetic brush of the developer, which was located at a magnetic pole just downstream of the

position regulated by the clearance regulating member in terms of rotation of the developing roller 3_a had a height T of 3.8 mm.

The paragraph beginning at page 7, line 2, was replaced with the following rewritten paragraph:

In other words, it has been found that the scattering of the developer can be drastically decreased by determining the regulating amount L for regulating the clearance above the developer carrying member 3a at a size not greater than the height T of the magnetic brush of the developer, which is located at a magnetic pole just downstream of a clearance regulated position in terms of rotation of the developer carrying member 3a. FIG. 3 shows graphs of the measured results of the clearance size L and the amount of the scattered developer in the heights T of the respective magnetic brushes in a single chart, and each of the graphs shows that the amount of the scattered developer decreases at a point where the clearance size L is determined at a size not greater than the size equal to the height T of each of the magnetic brushes.

The paragraph beginning at page 9, line 16, was replaced with the following rewritten paragraph:

The reason why locating [of] the clearance regulating member at this position is effective is that the distance between the surface of the developer and the clearance regulating member 4 is constant at this location since a developer storm caused by magnetic poles in the developer carrying member 3a has no influence [to] on the thickness of the layer of the developer at this location. In

other words, the developer is shown in some figures to build up [at] to the maximum at the magnetic developing pole and its subsequent downstream magnetic pole, where the magnetic brushes are produced as stated earlier. Actually, rotation of a sleeve on the surface of the developing roller 3 causes the developer to repeatedly collapse and build-up at these positions, producing a developer storm. On the other hand, the build up of the developer caused by the magnetic poles is not produced at an intermediate position between the magnetic developing pole and the subsequent magnetic pole, where the developer keeps a constant thickness since even rotation of the sleeve has no effects on the thickness of the developer. From this viewpoint, the clearance between the clearance regulating member 4 and the developer carrying member 3a can be always constant by determining such an intermediate position as the clearance regulated position.

The paragraph beginning at page 10, line 14, was replaced with the following rewritten paragraph:

Although both magnetic poles are, respectively, an N pole and an S pole in the [showned] shown examples, both magnetic poles may reverse in polarity or be the same in polarity.

The paragraph beginning at page 10, line 17, was replaced with the following rewritten paragraph:

When the developer carrying member 3a has a plurality of magnetic poles provided in an upper portion thereof, the clearance regulated position provided by the clearance regulating member

4 may be located between a first magnetic pole and a second magnetic pole downstream of a magnetic developing pole in terms of rotation of the developer carrying member 3a. For example, when the magnetic poles are provided so that a first magnetic pole as the magnetic developing pole is followed by a second magnetic pole and a third magnetic pole in the downstream direction of the first magnetic pole as shown in FIG. 6, the clearance regulated position may be located between the second magnetic pole and the third magnetic pole. This is because the distance between the surface of the developer and the clearance regulating member 4 can be kept constant at this location as well since a developer storm caused by magnetic poles in the developer carrying member 3a has no influence to the thickness of the layer of the developer at this location as stated earlier.

The paragraph beginning at page 12, line 24, was replaced with the following rewritten paragraph:

Conversely, when the cover 203 of the developing unit tends to become away from a central portion of the developer carrying member 3a in terms of shape due to deformation, it is preferable in conclusion that the leading edge of the clearance regulating member is formed so as to have a smaller original clearance at the central portion than the portions close to both ends of the developer carrying member 3a as shown in FIG. 10. Thus, it becomes possible to compensate for deformation. The clearance regulation can be provided in stable fashion, and the developer can be effectively restrained from scattering.

The paragraph beginning at page 13, line 9, was replaced with the following rewritten paragraph:

The present invention provides not only the arrangement of the image forming apparatus but also the arrangement of a developing device as stated earlier. Specifically, according to one aspect of the invention the developing device is characterized in that the device comprises a developer carrying member rotatable in a direction against gravity at a contacting point with, or a point closest to, a photosensitive member adapted to have an electrostatic latent image carried thereon, and a cover for sealing a developer to be conveyed by the developer carrying member in the cover, the developer carrying member carrying and conveying the developer stored therein to develop the electrostatic latent image on the photosensitive member; and the device further comprises at least a clearance regulating member provided so as to be free from contact with a surface of the developer carrying member, the clearance regulating member regulating a clearance for an upper side of the developer carrying member; wherein the clearance between the developer carrying member and the clearance regulating member is determined at a size not greater than a maximum height of the developer projected from the surface of the developer carrying member. [This arrangement corresponds to the arrangement recited in Claim 1.]

The paragraph beginning at page 14, line 6, was replaced with the following rewritten paragraph:

When the developer carrying member is configured to have magnetic poles, it is preferable, according to another aspect of the invention, that the clearance for the developer

carrying member provided by the clearance regulating member is determined at a size not greater than a height of a magnetic brush of the developer at a magnetic pole just downstream of a clearance regulated position in terms of rotation of the developer carrying member. [This arrangement corresponds to the arrangement defined in Claim 2].

The paragraph beginning at page 14, line 22, was replaced with the following rewritten paragraph:

FIG. 3 is a collection of graphs showing the measured results of an amount of a scattered developer and a clearance size in heights of respective magnetic brushes in a single chart;

The paragraph beginning at page 15, line 19, was replaced with the following rewritten paragraph:

FIG. 8 is a schematic view showing a state wherein a regulating [with] width for a clearance above a developer carrying member 3a is determined at a size not smaller than a developing width W2 on the developer carrying member;

The paragraph beginning at page 17, line 4, was replaced with the following rewritten paragraph:

FIG. 19 is a collection of schematic diagrams showing examples of [combination] combinations of the photosensitive member with the developer carrying member rotatable in a

direction against gravity at a contacting point with, or at a point closest to, the photosensitive member.

The paragraph beginning at page 19, line 14, was replaced with the following rewritten paragraph:

A portion of developing roller 3 appears from such a type of developing unit 2, and the remaining [portion] portions of the developing roller are covered by resin covers 203. Although the covers 203 forming the respective sides are connected each other, the covers cannot provide a complete seal for a reason in manufacture. Between upper and lower portions of the developing roller 3 and corresponding covers 203, clearances are required so that the developing roller 3 can [rotates] rotate without hindrance.

The paragraph beginning at page 22, line 7, was replaced with the following rewritten paragraph:

FIG. 15 shows another embodiment according to the present invention. As shown in this Figure, the clearance regulating member 4 is formed from a cover 203 of the developing unit 2. Specifically, the cover 203 has a leading edge projecting toward the developing roller 3. This arrangement can restrain the clearance regulating member 4 from being deformed, which [can not] cannot be overcome by a method to provide the cover 203 with the clearance regulating member 4 as a separate part. Thus, the cover 203 of the developing unit can have required rigidity as a whole, which leads to establishing of stable clearance regulation and to great contribution to a reduction in the scattered developer.

IN THE CLAIMS

The claims were AMENDED as follows:

1. (Amended) An image forming apparatus comprising:

a photosensitive member adapted to have an electrostatic latent image carried thereon;

a developing unit including a developer carrying-member rotatable in a direction against gravity at a contacting point with, or a point closest to, the photosensitive member, and a cover for sealing a developer to be conveyed by the developer carrying member therein, the developer-carrying member carrying and conveying the developer stored in the cover to develop the electrostatic latent image on the photosensitive member; and

a clearance regulating member provided so as to be free from contact with a surface of the developer carrying member, the clearance regulating member regulating a clearance for an upper side of the developer carrying member;

wherein the clearance between the developer carrying member and the clearance regulating member is determined at a size not greater than a maximum height of the developer projected from the surface of the developer carrying member and the clearance regulating member has a leading edge provided to be free from contact with the developer.

7. (Amended) The developing device according to Claim 6, wherein when the developer carrying member is configured to have magnetic poles, the clearance for the developer carrying member provided by the clearance regulating member is determined at a size not greater than a height of a magnetic brush of the developer at a magnetic pole just downstream of a clearance regulated position in terms of rotation of the developer carrying member and the clearance regulating member has a leading edge provided to be free from contact with the developer.